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Halon Options Technical Working
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April 20 – May 2, 2002**

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*Fire Research Division
Building and Fire Research Laboratory*

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UPDATE ON THE EVALUATION OF SELECTED NFPA 2001, AGENTS FOR SUPPRESSING CLASS “C” ENERGIZED FIRES FEATURING C₆F-KETONE

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ABSTRACT

The paper entitled “Evaluation of Selected NFPA 2001 Agents for Suppressing Class “C” Energized Fires” published at HOTWC in 1996 and updated at HOTWC in 1998 is being updated to include C₆ F-ketone. Test results indicate that the performance of C₆ F-ketone is comparable, to the other clean agents listed in the NFPA 2001.

INTRODUCTION

The C₆ F-ketone fire fluid is the first of the second-generation materials to be reviewed by Modular Protection[®]. It has demonstrated total flooding characteristics as a gas upon being super pressurized with nitrogen in current Halon type hardware and distribution.

OBJECTIVE

The objective of these tests is to compare the effectiveness of C₆ F-ketone in extinguishing and preventing reignition in Class “C” energized fires of polymeric materials ignited by a heated metal surface (nickel-chromium resistive wire energized by a direct current (DC) power supply.) Established protocol was used to conduct the test. The following:

- (1) Minimum concentration required to extinguish and
- (2) Minimum concentrations required to prevent re-flash/ reignition are shown for the application where the ignition source is not de-energized and is the cause of the fire event

AGENT SELECTION CRITERIA

The criteria considered for selecting the second generation clean agent to be tested was for the agent to (1) have a zero ozone depletion potential (ODP) (2) be approved as a total flooding agent for use in occupied areas by EPA (3) have a superior global warming potential (GWP) profile and (4) sustainable use.

TEST PROCEDURES

The criteria used for testing is listed below: *

Pre-burn	60 sec
Discharge time	≤ 10 sec
Flame extinguishments	≤ 30 sec
No re-flash / reignition	≤ 10 min

*This criteria was the same for previous testing reported:

DISCHARGE TESTS

The C₆ F-ketone was tested for (a) minimum concentration required for flame extinguishment and (b) minimum concentration required to prevent re-flash/ reignition for a period up to 10 minutes after initial flame extinguishment. The test protocol used to conduct test was that established previously for 192W and is reported in Table 1.

Table 1

Test	Agent	Test Energy Level (Watts)	Test Concentration (% by Volume)	Discharge Time (m:ss)	Extinguishing Time (m:ss)	Reflash or Reignition (m:ss)
1	C ₆ F-ketone	192	6.88	0:09	0:08	No
2	C ₆ F-ketone	192	6.29	0:09	0:01	No
3	C ₆ F-ketone	192	5.7	0:09	0:05	No
4	C ₆ F-ketone	192	5.1	0:08	0:23	No
5	C ₆ F-ketone	192	4.5	0:07	0:25	Yes

TEST RESULTS

The concentration comparison of the C₆ F-ketone vs. various current agents required to extinguish and prevent re-flash/ reignition at 192W energy levels is presented in Table 2.

- All of agents were able to suppress Class “C” energized fires at the 192W energy level, the concentrations were higher than those for heptane cup-burner listed in the NFPA 2001.
- Re-flash/ reignition occurred with an agent at cup burner concentrations for the 192 W. test.
- Higher agent concentrations (above the extinguishing level) did prevent re-flash/ reignition at 192 W.

- The concentration required to prevent re-flash/ reignition on 192W energy fires was less than Halon 1301.

Table 2

Agent	Energy Level	Extinguishing (min. conc., % by vol.)	Prevent Reflash/ Reignition (min. conc., % by vol.)
C ₆ F-ketone	192	4.5	5.1
HFC-227ea	192	8	9
HFC-236fa	192	6.5	9
FC-3-1-0	192	6.5	9.5

CONCLUSION

The new C₆ F-ketone fire fluid shows great promise as an equivalent concentration use material for the replacement of Halon 1301. The performance profile of, the C₆ F-ketone appears to be the next step forward in the attempt to remove/ replace global warming materials (PFC's and HFC's) for total flooding applications noted in the 1996 and 1998 reports.

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